

How to Make Fab Culture

A Framework for Collaborative Learning based
on Fab Academy 2015

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What is the purpose of this research?

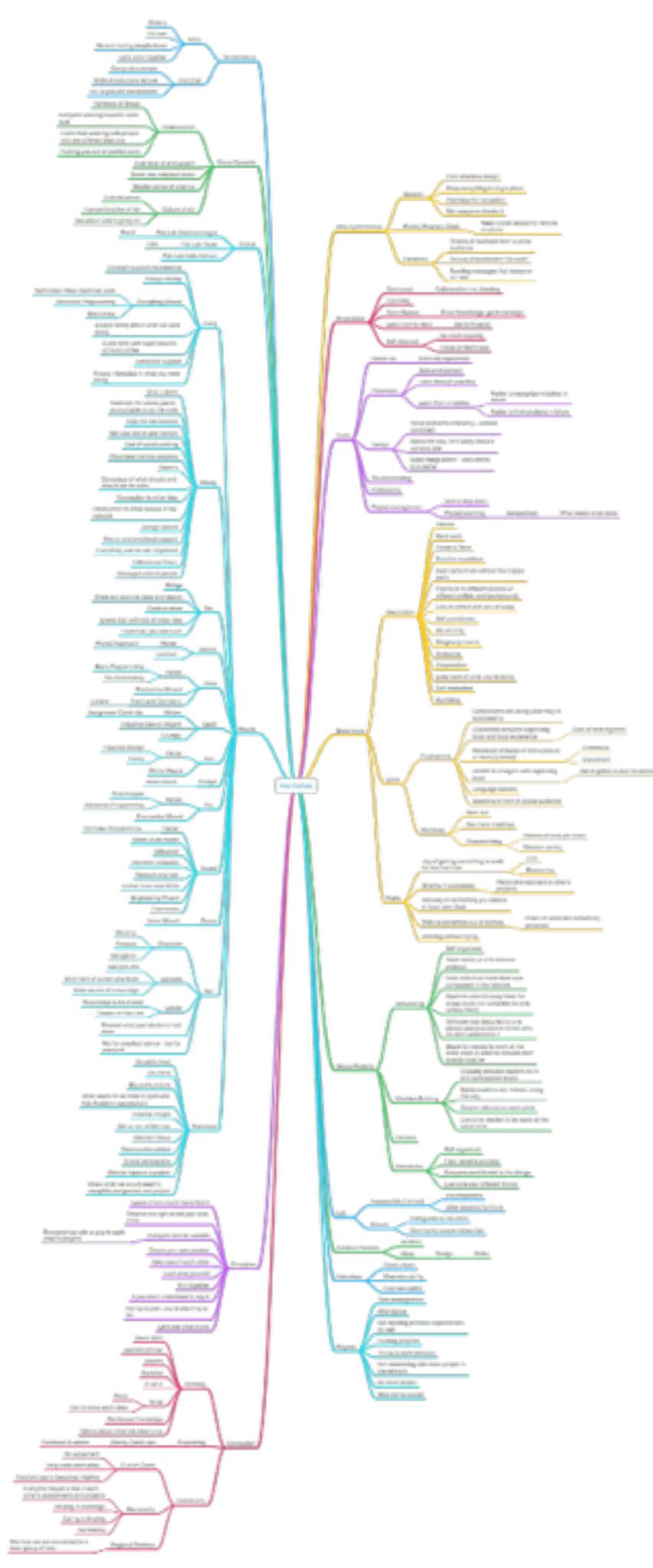
To design a framework for collaborative learning culture based on Fab Academy 2015

Why is this important?

Fab Academy is an experimental de-centralized education model that has produced hundreds of innovative prototypes around the world over the past 5 years. By revealing the dynamics between the organizing body and the participants through this framework, we can identify the key pillars of how to create an engaged and productive culture within Fab Labs.

How will this research be used?

- Help Fab Labs develop new programs that can deepen community engagement within the lab
- Show how other education institutions, social organizations and businesses can benefit from creating a collaborative learning environment



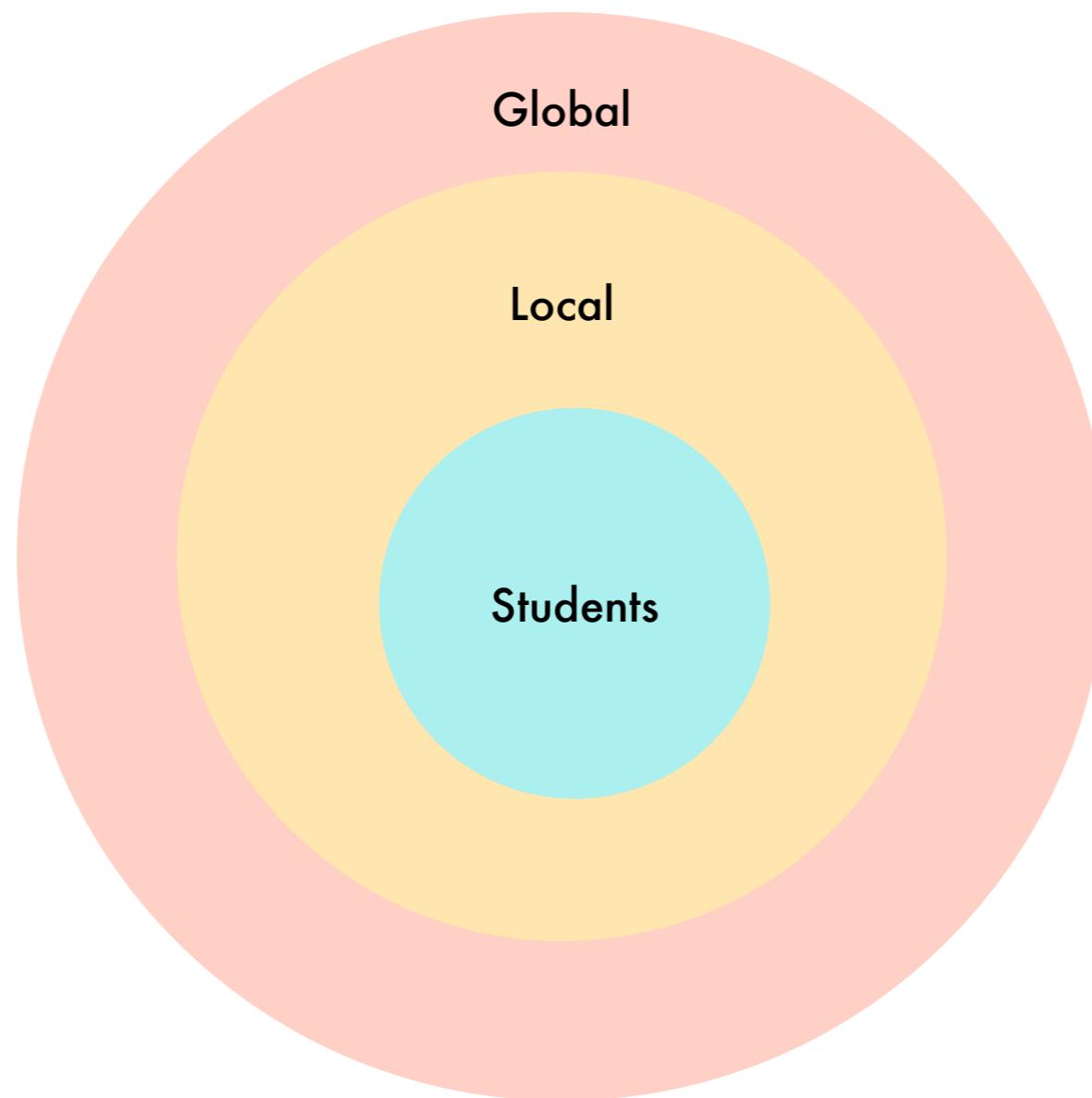
Methodology

This paper proposes an initial framework for collaborative learning based 12 hours of interviews with 2 instructors and 6 students of Fab Lab Wellington from Fab Academy 2015. The interview data has been hand coded for thematic saturation.

The author's intent is to share this initial theory with other Fab Lab members at Fab11 to gain a broader perspective on the findings. Based on the discussions started at Fab11, the author will further develop the theory through continued interviews with Fab Academy participants around the world, and literature reviews.

Designing a Student-Centred Experience

Fab Academy provided students with an open playing field to practice the fundamentals of digital fabrication. Despite a demanding and rigid curriculum, the organization was able to create a learning experience that allowed students the freedom to explore, experiment and create (almost) anything.



Anatomy of the Experience

Participants in each layer of this experience played a role that supports collaborative learning.

Role	Global Instructors	Local Instructors	Students
Space	Virtual	In-Person	In-Person
Purpose	Provides foundation by establishing goals, knowledge and timeframes.	Provide a safe, supportive and collaborative environment within which students could successfully complete the program	Contribute individual value to the group learning experience
Responsibilities	<ul style="list-style-type: none">Establish and maintain standard of qualityBe the "outside" perspective that connects local students with the global classroomProvide high-level, constructive feedbackHelp students focus on the "big picture" of Fab Academy	<ul style="list-style-type: none">Adapt global curriculum to the individual needs, expectations and abilities of local studentsEstablish the necessary social contracts and relationships to drive collaborationHelp students maintain pace within the programOngoing technical, design and social support	<ul style="list-style-type: none">Practice technical skills safely and efficientlyLearn by teaching peersLearn from mistakes (own and each other's)Seek and share learning resourcesWork together to solve problems
Activities	Lectures Curriculum Assignments Deadlines Assessment Criteria Tutorials	Design Workflow Troubleshooting Project Management Motivation Social Contracts	Research Ideation Problem solving Submit documentation Friendship

From Instructor's POV

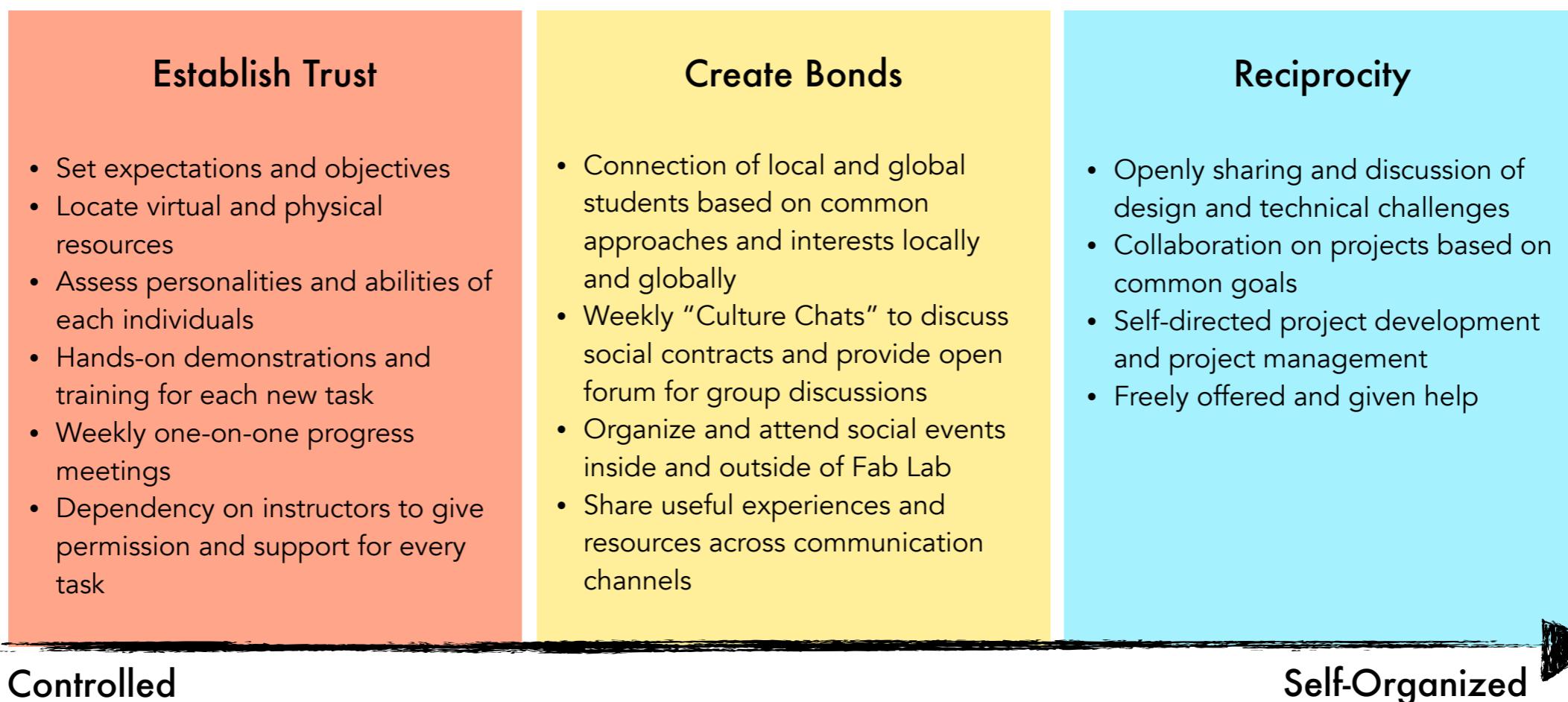
"We were teaching you how to navigate, to filter. And establish a clearly defined workflow in order to achieve the outcome of the week. The Fab Academy is so heavily process based, it's important to establish a clear workflow from the outset. We'd basically go through a module step-by-step to determine what needed to happen first and how to roll it out. We had experience with moulding and casting in our own practices, but once you start to break down that process to someone else, you realize there's a set sequence to go through. We had to determine the flow."

From Student's POV

"You've got someone who's kind of managing your progress, and where you want to be and how to start and all the steps. You've got someone who really wants you to succeed and looking out for how you're feeling throughout the process, and you've got someone who wants you to be motivated. There's not a lot of room for slacking, which is good."

Journey of the Experience

The Fab Academy experience transitions through 3 phases from being controlled primarily by global and local instructors to becoming self-organized by the students. As the students began to self-organize, the instructors spent less time enforcing the structure of the program, and more time on motivating and supporting individuals. As trust and bonds strengthened throughout the group, students became more active in seeking and offering supporting.



Culture Principles

What it means

Resulting Behaviour

Leave it how you would like to find it

To emphasize every individual's responsibility to keep workspaces, machines and communal spaces accessible and functional.

- Cleaner work surfaces
- Weekly clean-up sessions
- Well-maintained machines

Reserve the right to tell your own story

With Fab Academy's emphasis on documentation as well as the prevalent use of social media, it was important to establish a mutual-respect for each other's privacy

- Students sought other students and instructors in documentation
- Students sought permission before posting photos and links of other students and instructors online

Everyone can be a wizard

To dispel the myth that the instructors were the only experts, there was a concerted effort to recognize each student's strengths to benefit the group

- Students sought help from other students
- Students stepped up and leading projects
- Instructors entrusted greater responsibilities upon students

Create your own context

To remind students that they have the resources to establish a context before asking for help

- Students would conduct their own research before asking for help to solve problems
- Students asked more informed questions
- Instructors had a greater understanding of the challenges the students were facing and supported them appropriately

Take care of each other

Fab Labs can be dangerous with so many students doing so many things

- Students would pair up when using unfamiliar machines for the first time
- Students would remind other students to wear protective gear and safety processes
- Instructors had increased confidence that students would behave safely during off hours

Look after yourself

Fab Academy is fast paced and demanding course and it was important for students to actively maintain their wellbeing

- Students organized their lab schedules based on individual styles and approaches
- Students took breaks to enjoy life
- Students and instructors hosted social events to give everyone an opportunity to step away from projects and assignments

Win together

With students of such diverse skills, it was important to reinforce the fact that everyone in the group needed each other to succeed in Fab Academy

- Students made time to help other students catch-up on assignments
- Students self-organized on collaborative projects that would meet their common goals
- Students demonstrated great enthusiasm and support for each other's work during regional and global reviews
- Students acknowledged that they could not have completed Fab Academy without the support of the group

If you don't understand, say it

To remove fear or shame in asking questions

- Students identified gaps in their knowledge and were able to quickly close those gaps
- Instructors could quickly direct students towards solutions and resources

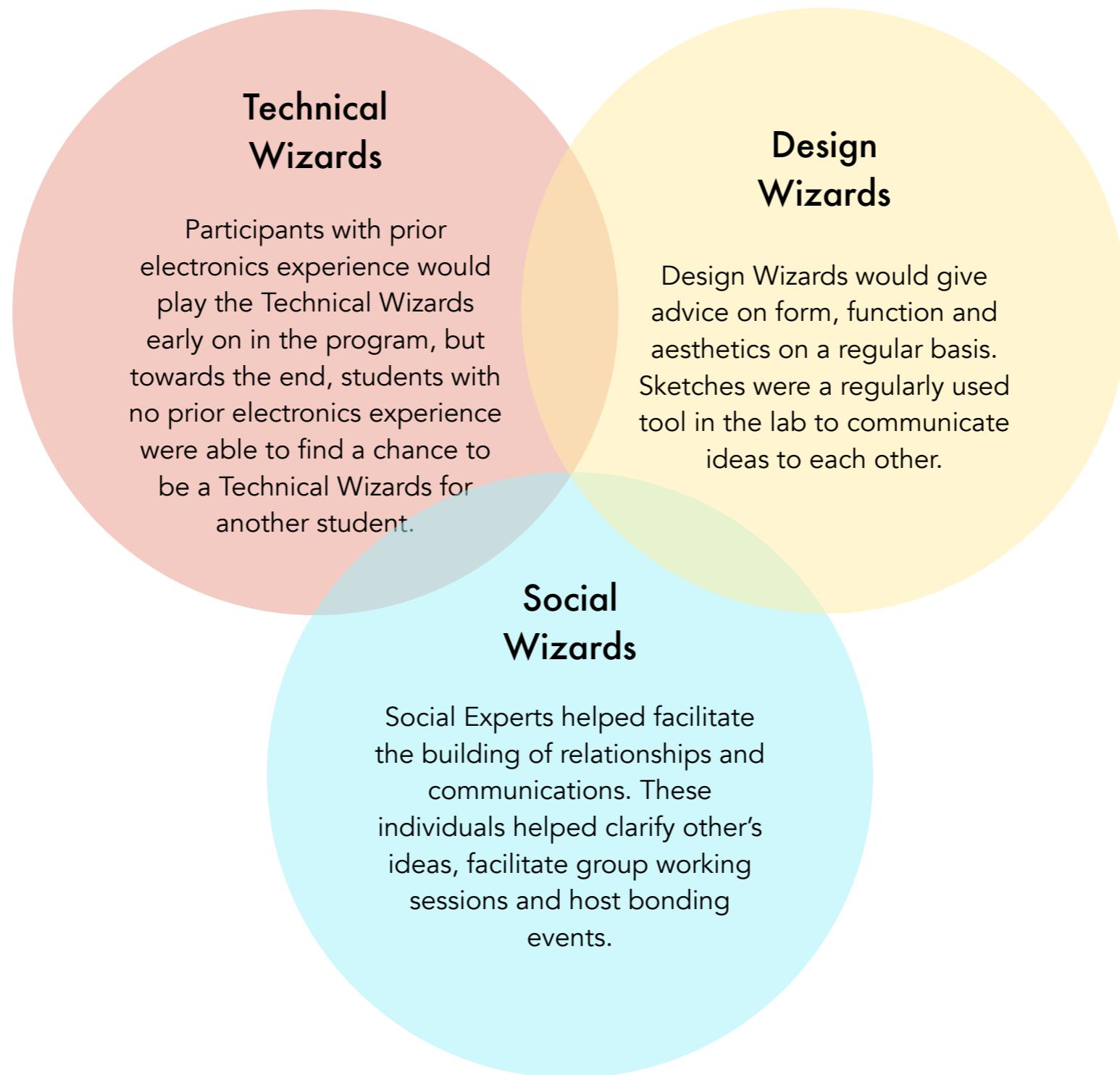
Failing to plan is planning to fail

To remind students not to take on the stress of others who failed to prepare appropriately for assignments and projects

- Students took responsibility of their own project planning and development
- Instructors trusted the students to complete assignments and projects

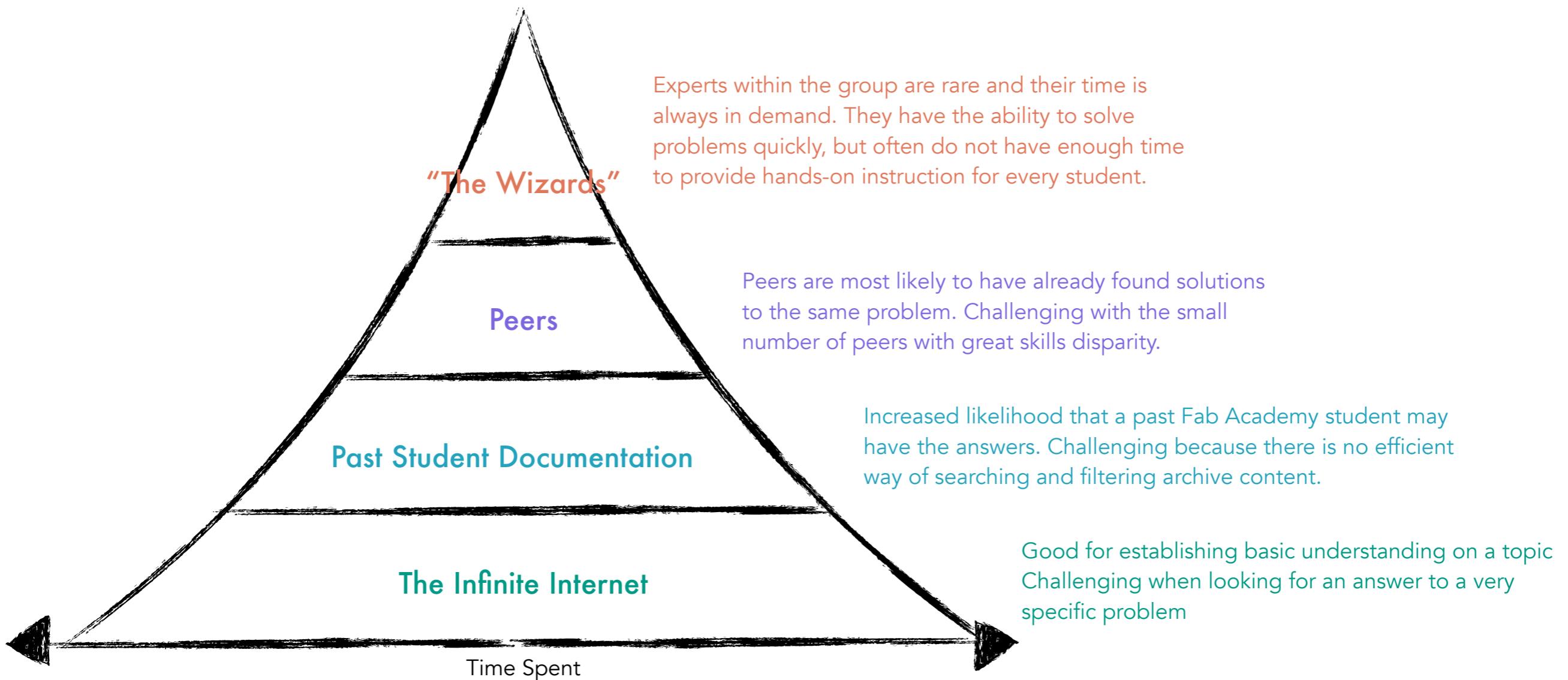
Reciprocity starts with Everyone Being Wizards

Reciprocity is only possible when everyone feels like they have something to contribute. At the beginning of the program, students reported feelings of guilt when asking for help because they believed they had nothing to contribute. As every participant found an opportunity to be a "Wizard", feelings of guilt was replaced by openness and helpfulness.



Distributed Problem Solving

In a learning environment where each student came from such varied backgrounds, they had to quickly shift the responsibility of problem solving from the instructors to the students. This graph was designed by one of the students to share how he approached problem solving more efficiently by leveraging the vast amount of communal knowledge that already existed to the knowledge experts within the local group.



From Instructor's POV

"I see my role as providing the space and the resources, and enable Fab Academy students to succeed. It was more important for me to make sure that people were working together, talking to each other and being inspired. It's easy to teach them how to use the machines, or how to program. The fun bit is working together. That was my focus."

From Students' POV

"I helped as much as anyone else. We're all 100% responsible for each other's growth. We're all intermingled in our helping of each other, it's kind of like we're not even individual people."

"I couldn't have done what I achieved without everyone else in the class. Can't imagine doing it without even one person in the group."

Building Towards Self-Organized Projects

Self-organized projects are a sign of a healthy collaborative culture. Early on in the program, group projects were mandated to the students to give them opportunities to learn about each other's working styles, strengths and interests. As the students began to trust each other and bond, they became increasingly comfortable with collaborating on projects.



Level of Collaboration

Vinyl Cutting

Students designed vinyl stickers that connected to each other.

Allowed students to express their individuality and learn more about others in the group.

Most students completed this assignment at different times and did not realize this was a group project.

Machine Building

All students participated on the first day to determine functional specifications and distribute labour.

Students broke off and worked as individuals and pairs on their part of the machine. There was increased sense of urgency due to mutual dependency.

Students with less mechanical design skills took on other responsibilities such as documentation and website design.

Only half the group was participating in the final stage of machine troubleshooting.

Networking

Students collaborated on this assignment even though it was not a mandatory group project.

Group workshop to establish network protocol. Broke off to create individual network node boards.

Came back together as a group for programming and completing the assignment. Working code was passed on down from student to student and adapted for each individual's node board.

Not all students participated.

Babeduino

4 students formed a group to create a Fabduino for their final project. This was not a mandatory assignment.

Students self-organized to work on different parts of the board design, rat nesting, cutting, stuffing, testing, fixing.

Each student was responsible for making their own Babeduino. Each iteration incorporated fixes for problems found in a previous version.

Students reported this to be the best electronics experience because each individual's needs were addressed in the design, and the frustrations of troubleshooting and fixing boards was evenly distributed across the group.

Controlled

Self-Organized

From Instructor's POV

"Group culture is about reciprocity, that was really evident in Networking. You had to have that reciprocity: you work alongside each other, and it comes back."

"At a certain point each person in the group should be able to identify their own strengths, distribute the division of labour equally. The group gets pretty good at identifying the individual that's best for each task. We might sense that there's some tension, but at that point it's outside of our control."

From Students' POV

"Networking - we didn't plan it to be group project, we just did it. Networking requires a group of devices and people, so it's perfect for a group oriented project. We had minor issues with clock speed, etc. My background in network engineering helped me structure that protocol session so that it would help teach people how to come up with a set of rules that make up a network protocol."

"Babeduino was awesome because we started working on it together by ourselves. Everybody did something useful. Someone did the schematic, someone else did the rats nest, the milling, testing, fixing, and we did this again and again through different iterations. It was never annoying because we were so many of us working on it. We all saw different things in the project. The Babeduino is awesome now because all four of us worked on it and we did it faster than if we were on our own."

Global Friendships on Social Networks

Social Network	Common Uses	Local	Regional	Global
Google+	<ul style="list-style-type: none"> Official source of local Fab Academy updates and information Shared useful links to learning resources Students used Google Drive to share project files and photos Hashtags were used to keep content organized 		X	
Class Email	<ul style="list-style-type: none"> Official source of global Fab Academy updates and information Often misused for individual project support Students would reply to questions if they had experience to share 			X
MCU	<ul style="list-style-type: none"> Official video conferencing channel Regional reviews Remote student meetings Regional instructor meetings 		X	X
Facebook	<ul style="list-style-type: none"> Facebook messaging was more reliable than Google+ messages Students engaged lightly with global, regional and local groups Students shared their project progress with their personal networks 	X	X	X
HipChat	<ul style="list-style-type: none"> Official chat platform to connect students during lectures and reviews High usage at launch, slowly faded Some students were able to make contact with regional peers due to time zone similarity 		X	X
Twitter	<ul style="list-style-type: none"> #fabacademy hashtag allowed global students to connect Live-tweeting of final project presentations increased engagement 			X
Instagram	<ul style="list-style-type: none"> #fabacademy hashtag allowed global students to connect Some students used Instagram video to document project progress - received support and motivation from global students 			X

Key Insights

- Collaborative learning is the result of a strong global and local foundation
- Global structure sets the bar for quality of student work, while local structure sets the bar for how students work together within the learning environment
- As the learning experience shifts from being controlled to self-organizing, students need to be given the freedom to forge their own path and instructors must maintain connection with students as they behave more autonomously
- Reciprocity is a key success indicator that students are learning, internalizing and practicing what they are learning through the course
- Reciprocity is only possible when trust and bonds have been established within the group
- Social contracts are essential for promoting behaviours that lead to self-organization
- Social contracts are defined by the group in words and phrases that are unique to their culture
- Reciprocity occurs when students are given the opportunity to add value to the learning experience (by teaching and leading - be Wizards)
- TO BE CONTINUED... :)